

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claim 1 (canceled)

1 Claim 2 (previously presented): The method of claim 11  
2 wherein the path is a label-switched path.

1 Claim 3 (previously presented): The method of claim 11  
2 wherein the message is a resource reservation protocol PATH  
3 message.

Claim 4 (canceled)

1 Claim 5 (currently amended): A method for processing, by a  
2 node of a network, a message from another node of the  
3 network, the message carrying at least one network path  
4 determination constraint, the method comprising:  
5 a) performing a constraint-based path determination  
6 to a next node to generate a partial path; and  
7 b) forwarding the message carrying the at least one  
8 network path determination constraint to an adjacent  
9 downstream node on the partial path,  
10 wherein the at least one network path  
11 determination constraint is expressed in the form of a  
12 program including one or more executable instructions.

1 Claim 6 (currently amended): A network node comprising:  
2 a) a path determination facility for performing a  
3 constraint-based path determination to a next node to  
4 generate a partial path; and  
5 b) a signaling facility for

6           i) receiving a message from another node of the  
7           network, the message carrying at least one  
8           network path determination constraint, and  
9           ii) forwarding the message carrying the at least  
10          one network path determination constraint to an  
11          adjacent downstream node on the partial path,  
12          wherein the at least one network path  
13          determination constraint is expressed in the form of a  
14          program including one or more executable instructions.

Claim 7 (canceled).

1   Claim 8 (previously presented): The method of claim 11  
2   wherein the at least one network path determination  
3   constraint includes a list of at least one explicit node  
4   specified to be a part of the path.

1   Claim 9 (original): The method of claim 8 wherein the list  
2   of at least one explicit node specified to be a part of the  
3   path identifies at least one of a strict-hop node and a  
4   loose-hop node.

1   Claim 10 (original): The method of claim 8 wherein the  
2   message forwarded to the adjacent downstream node on the  
3   partial path includes an updated list, and  
4            wherein the node maintains the initial instance  
5   of the list, as received.

1   Claim 11 (currently amended): A method for processing, by  
2   a node of a network, a message from another node of the  
3   network, the message carrying at least one network path  
4   determination constraint, the method comprising:

5 a) performing a constraint-based path determination  
6 to a next node selected from a group of nodes  
7 consisting of  
8 (i) an area border node,  
9 (ii) an autonomous system gateway node,  
10 (iii) a node that can process one of the at least  
11 one network path determination constraint carried  
12 by the message which the present node cannot, or  
13 will not, evaluate,  
14 (iv) a specified loose-hop node, and  
15 (v) a node to which constraint processing is  
16 delegated,  
17 to generate a partial path; and  
18 b) forwarding the message carrying the at least one  
19 network path determination constraint to an adjacent  
20 downstream node on the partial path, or to a delegated  
21 node that is able to carry out the path determination,  
22 wherein the at least one network path determination  
23 constraint is expressed in the form of a program including  
24 one or more executable instructions.

1 Claim 12 (original): The method of claim 11 wherein each  
2 executable instruction includes:

- 3 - information about a first operand;  
4 - information about a second operand; and  
5 - an operation code.

1 Claim 13 (original): The method of claim 12 wherein the  
2 operation code identifies an operation selected from a  
3 group of operations consisting of:

- 4 - bit-wise AND;  
5 - bit-wise OR;

- 6 - bit-wise XOR;
- 7 - bit-wise equality;
- 8 - bit-wise inversion;
- 9 - Boolean AND;
- 10 - Boolean OR; and
- 11 - Boolean negation.

1 Claim 14 (original): The method of claim 12 wherein the  
2 information about either of the first operand or the second  
3 operand is a pointer to a register.

1 Claim 15 (original): The method of claim 14 wherein the  
2 register is a register which contains a link attribute.

1 Claim 16 (original): The method of claim 14 wherein the  
2 register is a read-only register.

1 Claim 17 (previously presented): The method of claim 11  
2 further comprising:  
3 - generating a list which specifies nodes on the  
4 partial path as strict hop nodes; and  
5 - forwarding the list to an adjacent downstream node  
6 on the partial path.

1 Claim 18 (original): A method for processing, by a node of  
2 a network, a message carrying at least one network path  
3 determination constraint, the method comprising:  
4 a) determining whether the node is a tail-end node, a  
5 head-end node, or an intermediate node of the path;  
6 b) if it is determined that the node is a tail-end  
7 node and each of the at least one network path  
8 determination constraint has been satisfied, then

9 signaling back to an upstream node of the path that  
10 the path is OK;  
11 c) if it is determined that the node is one of a  
12 head-end node and an intermediate node, then  
13 i) determining whether (a) a strict-hop node is  
14 specified as a next node of an explicit path  
15 constraint, (b) a loose-hop node is specified as  
16 a next node of an explicit path constraint, or  
17 (c) no node is specified as an explicit path  
18 constraint,  
19 ii) if a strict-hop node is specified as a next  
20 node of an explicit path constraint, then  
21 A) applying each of the at least one  
22 network path determination constraint to an  
23 appropriate one of a link between the node  
24 and the strict-hop node, the strict-hop  
25 node, and the partial path defined,  
26 B) if each of the at least one constraint  
27 is satisfied, then forwarding a message  
28 carrying the at least one network path  
29 determination constraint to the strict-hop  
30 node, and  
31 C) if any one of the at least one  
32 constraint was not satisfied, then signaling  
33 a path error back to an upstream node,  
34 iii) if one of (a) a loose hop node is specified  
35 as a next node of an explicit path constraint or  
36 (b) no node is specified as an explicit path  
37 constraint, then  
38 A) performing a constraint-based path  
39 determination to a next node selected from a  
40 group of nodes consisting of

41 (1) an area border node,  
42 (2) an autonomous system gateway node,  
43 (3) a node that can process one of the  
44 at least one network path determination  
45 constraint carried by the message which  
46 the present node cannot, or is  
47 unwilling to, evaluate,  
48 (4) a specified loose-hop node, and  
49 (5) a node to which constraint  
50 processing is delegated,  
51 to generate a partial path, and  
52 B) forwarding the message carrying the at  
53 least one network path determination  
54 constraint to an adjacent downstream  
55 node on the partial path.

1 Claim 19 (original): The method of claim 18 wherein the  
2 upstream node is the head-end node.

1 Claim 20 (currently amended): A computer-readable  
2 ~~machine-readable~~ medium having stored thereon at least one  
3 network path determination constraint expressed as an  
4 executable instruction, each executable instruction  
5 comprising:  
6 - information concerning a first operand;  
7 - information concerning a second operand; and  
8 - an operation code,  
9 wherein the machine-readable medium is a  
10 component of a first node of a communications network, and  
11 wherein the at least one network path  
12 determination constraint is expressed as an executable  
13 program including one or more instructions, and wherein the

14 executable program was received in a message from a second  
15 node of the communications network.

1 Claim 21 (currently amended): The computer-readable  
2 ~~machine-readable~~ medium of claim 20 wherein the operation  
3 code denotes an operation selected from a group of  
4 operations consisting of:  
5 - bit-wise AND;  
6 - bit-wise OR;  
7 - bit-wise XOR;  
8 - bit-wise equality;  
9 - bit-wise inversion;  
10 - Boolean AND;  
11 - Boolean OR; and  
12 - Boolean negation.

1 Claim 22 (currently amended): The computer-readable  
2 ~~machine-readable~~ medium of claim 20 wherein the information  
3 concerning either of the first operand or the second  
4 operand is a pointer to a register.

1 Claim 23 (currently amended): The computer-readable  
2 ~~machine-readable~~ medium of claim 22 wherein the register is  
3 a register that contains a link attribute.

1 Claim 24 (currently amended): The computer-readable  
2 ~~machine-readable~~ medium of claim 22 wherein the link  
3 attribute is selected from a group of link attributes  
4 consisting of:  
5 - link type;  
6 - maximum link bandwidth;  
7 - maximum reservable link bandwidth;

- 8 - current bandwidth reservation;
- 9 - current bandwidth usage;
- 10 - link coloring;
- 11 - link administrative group;
- 12 - link delay;
- 13 - link media type;
- 14 - optical link wavelength;
- 15 - optical link minimum signal to noise ratio;
- 16 - optical link maximum power dispersion;
- 17 - optical link transmission power; and
- 18 - optical link receiver sensitivity.

1 Claim 25 (currently amended): The computer-readable  
2 ~~machine-readable~~ medium of claim 22 wherein the register is  
3 a register that contains a node attribute.

1 Claim 26 (currently amended): The computer-readable  
2 ~~machine-readable~~ medium of claim 25 wherein the node  
3 attribute is selected from a group of node attributes  
4 consisting of:  
5 - node type;  
6 - minimum node throughput;  
7 - node quality of service support; and  
8 - node queuing type.

1 Claim 27 (currently amended): The computer-readable  
2 ~~machine-readable~~ medium of claim 20 having further stored  
3 thereon at least one network path determination constraint  
4 as a list of at least one explicit node that is specified  
5 to be a part of the network path.



1 Claim 28 (currently amended): The computer-readable  
2 ~~machine-readable~~ medium of claim 27 wherein the at least  
3 one explicit node is one of a loose-hop node and a  
4 strict-hop node.

1 Claim 29 (previously presented): A network node  
2 comprising:  
3 a) a plurality of registers including attribute  
4 registers, the attribute registers storing attributes  
5 of links in the network; and  
6 b) a machine-readable medium having stored thereon  
7 at least one network path determination constraint as  
8 an instruction, each executable instruction including  
9 i) a first operand pointer,  
10 ii) a second operand pointer, and  
11 iii) an operation code,  
12 wherein at least one of the first and second  
13 operand pointers points to one of the attribute  
14 registers, and  
15 wherein the executable instruction was  
16 received in a message from another network node.

1 Claim 30 (original): The network node of claim 29 wherein  
2 the plurality of registers further includes general purpose  
3 registers,  
4 wherein each of the attribute registers is a  
5 read-only register, and  
6 wherein each of the general purpose registers is  
7 read/write register.

1 Claim 31 (original): The network node of claim 29 wherein  
2 the machine-readable medium also has stored thereon at

3 least one network path determination constraint as a list  
4 of at least one explicit node that is specified to be a  
5 part of the network path.

1 Claim 32 (original): The network node of claim 31 wherein  
2 the at least one explicitly specified node is one of a  
3 loose-hop node and a strict-hop node.

1 Claim 33 (original): The network node of claim 29 wherein  
2 the plurality of registers further include accumulation  
3 registers storing cumulative attributes of a path.

1 Claim 34 (previously presented ): A computer-readable  
2 storage medium having stored thereon a message to be  
3 communicated between different network nodes in a  
4 communications network, the message comprising:  
5 a) a program including one or more executable  
6 instructions, each executable instruction encoding at  
7 least one network path determination constraint; and  
8 b) a list of at least one explicit node specified to  
9 be a part of the path.

1 Claim 35 (previously presented ): The computer-readable  
2 storage medium of claim 34 wherein the executable  
3 instruction includes:  
4 - information concerning a first operand;  
5 - information concerning a second operand; and  
6 - an operation code.

1 Claim 36 (original): A method for processing, by a node of  
2 a network, a message carrying at least one network path  
3 determination constraint, the method comprising:

4 a) if the tail-end node of the path is in a part of  
5 the network, the topology of which is not known by the  
6 node, then performing a constraint-based path  
7 determination to a next node selected from a group of  
8 nodes consisting of  
9 (i) an area border node, and  
10 (ii) an autonomous system gateway node,  
11 to generate a partial path; and  
12 b) forwarding the message carrying the at least one  
13 network path determination constraint to an adjacent  
14 downstream node on the partial path.

1 Claim 37 (currently amended): A method for processing, by  
2 a node of a network, a message from another node of the  
3 network, the message carrying at least one network path  
4 determination constraint, the method comprising:  
5 a) if a next node specified in a list of explicit  
6 nodes is a loose-hop node, then performing a  
7 constraint-based path determination to the next  
8 loose-hop node to generate a partial path; and  
9 b) forwarding the message carrying the at least one  
10 network path determination constraint to an adjacent  
11 downstream node on the partial path,  
12 wherein the at least one network path  
13 determination constraint is expressed in the form of a  
14 program including one or more executable instructions.

1 Claim 38 (currently amended): A method for processing, by  
2 a node of a network, a message from another node of the  
3 network, the message carrying at least one network path  
4 determination constraint, the method comprising:

5 a) if the node cannot process any one of the at least  
6 one network path determination constraint, performing  
7 a constraint-based path determination to a node that  
8 can process that one of the at least one network path  
9 determination constraint, to generate a partial path;  
10 and  
11 b) forwarding the message carrying the at least one  
12 network path determination constraint to an adjacent  
13 downstream node on the partial path,  
14 wherein the at least one network path  
15 determination constraint is expressed in the form of a  
16 program including one or more executable instructions.

1 Claim 39 (currently amended): A method for processing, by  
2 a node of a network, a message from another node of the  
3 network, the message carrying at least one network path  
4 determination constraint, the method comprising:  
5 a) if constraint processing has been delegated to  
6 another network element, performing a constraint-based  
7 path determination to the other network element to  
8 which constraint processing has been delegated to  
9 generate a partial path; and  
10 b) forwarding the message carrying the at least one  
11 network path determination constraint to an adjacent  
12 downstream node on the partial path,  
13 wherein the at least one network path  
14 determination constraint is expressed in the form of a  
15 program including one or more executable instructions.

1 Claim 40 (previously presented): A network node  
2 comprising:

- 3 a) a path determination facility for performing a  
4 constraint-based path determination to a next node  
5 to generate a partial path;  
6 b) a signaling facility for  
7 i) receiving a message carrying at least one  
8 network path determination constraint, and  
9 ii) forwarding the message carrying the at  
10 least one network path determination constraint  
11 to an adjacent downstream node on the partial  
12 path;  
13 c) a process for generating a traffic engineering  
14 database; and  
15 d) a traffic engineering database generated by the  
16 processing for generating,  
17 wherein the path determination facility is further  
18 adapted to determine at least a part of a path based  
19 on  
20 i) contents of the traffic engineering  
21 database, and  
22 ii) at least one path constraint received from  
23 the signaling facility,  
24 wherein, if the path determination facility  
25 cannot determine a complete constraint-based path to a  
26 specified tail-end node, then the path determination  
27 facility performs a constraint-based path determination  
28 to a next node selected from a group of nodes consisting  
29 of  
30 - an area border node,  
31 - an autonomous system gateway node,

32                   - a node that can process one of the at least  
33                   one network path determination constraint  
34                   carried by the message which cannot be  
35                   evaluated by the present node,  
36                   - a specified loose-hop node, and  
37                   - a node to which constraint processing is  
38       delegated,  
39                   to generate a partial path, and  
40       the signaling facility forwards a message carrying the at  
41       least one path constraint to an adjacent downstream node  
42       on the partial path.

1       Claim 41 (original): The routing facility of claim 40  
2       wherein the path is a label-switched path.

Claims 42-52 (canceled)

1       Claim 53 (previously presented): The method of claim 5,  
2       wherein the node is an intermediary node, and wherein the  
3       act of performing a constraint-based path determination  
4       includes determining whether a link from the node to the  
5       next node specified in a first portion of the path  
6       satisfies the set of at least one constraint.

1       Claim 54 (previously presented): A method for  
2       processing, by a node of a network, a message carrying at  
3       least one network path determination constraint, the  
4       method comprising:

5 a) performing a constraint-based path determination  
6 to a next node to generate a partial path;  
7 b) forwarding the message carrying the at least one  
8 network path determination constraint to an adjacent  
9 downstream node on the partial path, wherein the  
10 node is an intermediary node, and wherein the act of  
11 performing a constraint-based path determination  
12 includes determining whether a link from the node to  
13 the next node specified in the first portion of the  
14 path satisfies the set of at least one constraint;  
15 and  
16 c) if the link from the first intermediary node to  
17 the next node specified in a first portion of the  
18 path is determined to satisfy the set of at least  
19 one constraint, then transmitting the received  
20 message to the next node.

1 Claim 55 (previously presented): A method for  
2 processing, by a node of a network, a message carrying at  
3 least one network path determination constraint, the  
4 method comprising:  
5 a) performing a constraint-based path determination  
6 to a next node to generate a partial path;  
7 b) forwarding the message carrying the at least one  
8 network path determination constraint to an adjacent  
9 downstream node on the partial path, wherein the  
10 node is an intermediary node, and wherein the act of  
11 performing a constraint-based path determination  
12 includes determining whether a link from the node to  
13 the next node specified in the first portion of the

14 path satisfies the set of at least one constraint;  
15 and  
16 c) if the link from the first intermediary node to  
17 the next node specified in a first portion of the  
18 path is determined not to satisfy the set of at  
19 least one constraint, then transmitting an error  
20 message back to the source node.

Claim 56 (canceled)

1 Claim 57 (previously presented): The computer-readable  
2 storage medium of claim 35 wherein first operand  
3 specifies a memory location in which a value for an  
4 attribute of a network node or link is stored, and the  
5 second operand represents a constraint value for the  
6 attribute, and further comprising:  
7 c) a code specifying an operation to be performed  
8 on the first operand and second operand; and  
9 d) a result portion specifying a memory location in  
10 which a result of the operation performed on the  
11 first operand and second operand is stored.

Claims 58 and 59 (canceled)

1 Claim 60 (previously presented): A network node  
2 comprising:  
3 a) a plurality of registers including attribute  
4 registers, the attribute registers storing  
5 attributes of links in the network; and



6           b) a machine-readable medium having stored thereon  
7           at least one network path determination constraint  
8           as an executable instruction, each executable  
9           instruction including  
10                  i) a first operand pointer,  
11                  ii) a second operand pointer, and  
12                  iii) an operation code,  
13                  wherein at least one of the first and  
14                  second operand pointers points to one of the  
15                  attribute registers, and  
16                  wherein the executable instruction was received  
17           in a message from another network node, and  
18           wherein the machine-readable medium further stores  
19           thereon a table including  
20                  i) a first entry representing a first  
21                  attribute of a node or link connected to the  
22                  node,  
23                  ii) a second entry representing an accumulated  
24                  value for a second attribute of a node or link  
25                  connected to the node, and  
26                  iii) a third entry storing a result of a  
27                  specified operation performed on one of the  
28                  first entry and the second entry.

1       Claim 61 (previously presented): A network node  
2       comprising:  
3           a) a plurality of registers including attribute  
4           registers, the attribute registers storing  
5           attributes of links in the network; and

6           b) a machine-readable medium having stored thereon  
7           at least one network path determination constraint  
8           as an executable instruction, each executable  
9           instruction including  
10                i) a first operand pointer,  
11                ii) a second operand pointer, and  
12                iii) an operation code,  
13                wherein at least one of the first and  
14           second operand pointers points to one of the  
15           attribute registers, and  
16                wherein the executable instruction was received  
17           in a message from another network node, and  
18           wherein the machine-readable medium further stores  
19           thereon a memory data structure including  
20                i) a first portion storing attributes of nodes  
21                or links in the network,  
22                ii) a second portion storing network-path  
23                constraints, and  
24                iii) a third portion storing instructions for  
25           performing operations on the stored attributes  
26           and the stored constraints; and further  
27           comprising:  
28           c) a processor for executing the instructions  
29           stored in the third portion of memory and computing  
30           a path in the network based on results of the  
31           executed instructions.

Claim 62 (canceled)

1 Claim 63 (previously presented): The network node of  
2 claim 6 wherein if constraint processing has been  
3 delegated to another network element, then the path  
4 determination facility further performs a  
5 constraint-based path determination to the other network  
6 element to which constraint processing has been delegated  
7 to generate a partial path.

Claims 64-69 (canceled)

1 Claim 70 (currently amended): A method for processing, by  
2 a node of a network, a message from another node of the  
3 network, the message carrying at least one network path  
4 determination constraint, the method comprising:  
5 a) determining whether to delegate constraint  
6 processing to another device; and  
7 b) if it has been determined that constraint  
8 processing has been delegated to another network  
9 element, forwarding the message carrying the at least  
10 one network path determination constraint to the other  
11 device.

1 Claim 71 (previously presented): The method of claim 36  
2 wherein each of the at least one network path determination  
3 constraint is an executable instruction.

1 Claim 72 (previously presented): The method of claim 70  
2 wherein each of the at least one network path determination  
3 constraint is an executable instruction.

Claim 73-78 (canceled)

1 Claim 79 (previously presented): The method of claim 5,  
2 wherein the program includes a plurality of executable  
3 instructions.

1 Claim 80 (previously presented): The method of claim 6,  
2 wherein the program includes a plurality of executable  
3 instructions.

1 Claim 81 (previously presented): The method of claim 11,  
2 wherein the program includes a plurality of executable  
3 instructions.

1 Claim 82 (previously presented): The method of claim 37,  
2 wherein the program includes a plurality of executable  
3 instructions.

1 Claim 83 (previously presented): The method of claim 38,  
2 wherein the program includes a plurality of executable  
3 instructions.

1 Claim 84 (previously presented): The method of claim 39,  
2 wherein the program includes a plurality of executable  
3 instructions.